

INTEGRATED SCIENCE 3

CALIFORNIA CONTENT STANDARDS: BIOLOGY/LIFE SCIENCES	2003 Blueprint	%
Cell Biology	4	6.7%
1. The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells. As a basis for understanding this concept:		
b. <i>Students know</i> enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings.	✓	
f. <i>Students know</i> usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide.	✓	
g. <i>Students know</i> the role of the mitochondria in making stored chemical-bond energy available to cells by completing the breakdown of glucose to carbon dioxide.	✓	
i. * <i>Students know</i> how chemiosmotic gradients in the mitochondria and chloroplast store energy for ATP production.	NA*	
Genetics	6	10.0%
2. Mutation and sexual reproduction lead to genetic variation in a population. As a basis for understanding this concept:		
d. <i>Students know</i> new combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).	✓	
4. Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:		
c. <i>Students know</i> how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in an encoded protein.	✓	
d. <i>Students know</i> specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves.	✓	
e. <i>Students know</i> proteins can differ from one another in the number and sequence of amino acids.	✓	
f. * <i>Students know</i> why proteins having different amino acid sequences typically have different shapes and chemical properties.	NA*	
5. The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept:		
c. <i>Students know</i> how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.	✓	
d. * <i>Students know</i> how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation, and transformation) is used to construct recombinant DNA molecules.	NA*	
e. * <i>Students know</i> how exogenous DNA can be inserted into bacterial cells to alter their genetic makeup and support expression of new protein products.	NA*	
Evolution	6	10.0%
7. The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time. As a basis for understanding this concept:		
a. <i>Students know</i> why natural selection acts on the phenotype rather than the genotype of an organism.	✓	
b. <i>Students know</i> why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.	✓	
c. <i>Students know</i> new mutations are constantly being generated in a gene pool.	✓	
d. <i>Students know</i> variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.	✓	
e. * <i>Students know</i> the conditions for Hardy-Weinberg equilibrium in a population and why these conditions are not likely to appear in nature.	NA*	
f. * <i>Students know</i> how to solve the Hardy-Weinberg equation to predict the frequency of genotypes in a population, given the frequency of phenotypes.	NA*	

*Not assessed

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Evolution, continued		
8. Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:		
c. <i>Students know</i> the effects of genetic drift on the diversity of organisms in a population.	✓	
d. <i>Students know</i> reproductive or geographic isolation affects speciation.	✓	
f.* <i>Students know</i> how to use comparative embryology, DNA or protein sequence comparisons, and other independent sources of data to create a branching diagram (cladogram) that shows probable evolutionary relationships.	NA*	
g.* <i>Students know</i> how several independent molecular clocks, calibrated against each other and combined with evidence from the fossil record, can help to estimate how long ago various groups of organisms diverged evolutionarily from one another.	NA*	
Total in Biology/Life Sciences	16	26.7%

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CALIFORNIA CONTENT STANDARDS: CHEMISTRY	2003 Blueprint	%
Conservation of Matter And Stoichiometry	8	13.3%
3. The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants. As a basis for understanding this concept:		
b. <i>Students know</i> the quantity <i>one mole</i> is set by defining one mole of carbon 12 atoms to have a mass of exactly 12 grams.	✓	
c. <i>Students know</i> one mole equals 6.02×10^{23} particles (atoms or molecules).	✓	
d. <i>Students know</i> how to determine the molar mass of a molecule from its chemical formula and a table of atomic masses and how to convert the mass of a molecular substance to moles, number of particles, or volume of gas at standard temperature and pressure.	✓	
e. <i>Students know</i> how to calculate the masses of reactants and products in a chemical reaction from the mass of one of the reactants or products and the relevant atomic masses.	✓	
f.* <i>Students know</i> how to calculate percent yield in a chemical reaction.	NA*	
g.* <i>Students know</i> how to identify reactions that involve oxidation and reduction and how to balance oxidation-reduction reactions.	NA*	
Gases and Their Properties	6	10.0%
4. The kinetic molecular theory describes the motion of atoms and molecules and explains the properties of gases. As a basis for understanding this concept:		
a. <i>Students know</i> the random motion of molecules and their collisions with a surface create the observable pressure on that surface.	✓	
b. <i>Students know</i> the random motion of molecules explains the diffusion of gases.	✓	
c. <i>Students know</i> how to apply the gas laws to relations between the pressure, temperature, and volume of any amount of an ideal gas or any mixture of ideal gases.	✓	
d. <i>Students know</i> the values and meanings of standard temperature and pressure (STP).	✓	
e. <i>Students know</i> how to convert between the Celsius and Kelvin temperature scales.	✓	
f. <i>Students know</i> there is no temperature lower than 0 Kelvin.	✓	
Acids and Bases	0	0.0%
5. Acids, bases, and salts are three classes of compounds that form ions in water solutions. As a basis for understanding this concept:		
e.* <i>Students know</i> the Arrhenius, Brønsted-Lowry, and Lewis acid-base definitions.	NA*	
f.* <i>Students know</i> how to calculate pH from the hydrogen-ion concentration.	NA*	
g.* <i>Students know</i> buffers stabilize pH in acid-base reactions.	NA*	
Solutions	1	1.7%
6. Solutions are homogenous mixtures of two or more substances. As a basis for understanding this concept:		
d. <i>Students know</i> how to calculate the concentration of a solute in terms of grams per liter, molarity, parts per million, and percent composition.	✓	
e.* <i>Students know</i> the relationship between the molality of a solute in a solution and the solution's depressed freezing point or elevated boiling point.	NA*	
Reaction Rates	4	6.7%
8. Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules. As a basis for understanding this concept:		
a. <i>Students know</i> the rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time.	✓	
b. <i>Students know</i> how reaction rates depend on such factors as concentration, temperature, and pressure.	✓	
c. <i>Students know</i> the role a catalyst plays in increasing the reaction rate.	✓	
d.* <i>Students know</i> the definition and role of activation energy in a chemical reaction.	NA*	

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Chemical Equilibrium	4	6.7%
9. Chemical equilibrium is a dynamic process at the molecular level. As a basis for understanding this concept:		
a. <i>Students know</i> how to use LeChatelier's principle to predict the effect of changes in concentration, temperature, and pressure.	✓	
b. <i>Students know</i> equilibrium is established when forward and reverse reaction rates are equal.	✓	
c.* <i>Students know</i> how to write and calculate an equilibrium constant expression for a reaction.	NA*	
TOTAL in Chemistry	23	38.4%

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CALIFORNIA CONTENT STANDARDS: EARTH SCIENCES	2003 Blueprint	%
Energy in the Earth System	2	3.3%
4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept:		
c. <i>Students know</i> the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.	✓	
d. * <i>Students know</i> the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.	NA*	
Structure and Composition of the Atmosphere	5	8.3%
8. Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life. As a basis for understanding this concept:		
a. <i>Students know</i> the thermal structure and chemical composition of the atmosphere.	✓	
b. <i>Students know</i> how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.	✓	
c. <i>Students know</i> the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities.	✓	
TOTAL in Earth Sciences	7	11.6%

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CALIFORNIA CONTENT STANDARDS: PHYSICS	2003 Blueprint	%
Motion and Forces	1	1.7%
1. Newton's laws predict the motion of most objects. As a basis for understanding this concept:		
g. <i>Students know</i> circular motion requires the application of a constant force directed toward the center of the circle.	✓	
i.* <i>Students know</i> how to solve two-dimensional trajectory problems.	NA*	
j.* <i>Students know</i> how to resolve two-dimensional vectors into their components and calculate the magnitude and direction of a vector from its components.	NA*	
k.* <i>Students know</i> how to solve two-dimensional problems involving balanced forces (statics).	NA*	
m.* <i>Students know</i> how to solve problems involving the forces between two electric charges at a distance (Coulomb's law) or the forces between two masses at a distance (universal gravitation).	NA*	
Conservation of Energy and Momentum	5	8.3%
2. The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. As a basis for understanding this concept:		
e. <i>Students know</i> momentum is a separately conserved quantity different from energy.	✓	
f. <i>Students know</i> an unbalanced force on an object produces a change in its momentum.	✓	
g. <i>Students know</i> how to solve problems involving elastic and inelastic collisions in one dimension by using the principles of conservation of momentum and energy.	✓	
h.* <i>Students know</i> how to solve problems involving conservation of energy in simple systems with various sources of potential energy, such as capacitors and springs.	NA*	
Electric and Magnetic Phenomena	2	3.3%
5. Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept:		
f. <i>Students know</i> magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources.	✓	
g. <i>Students know</i> how to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.	✓	
TOTAL in Physics	8	13.3%

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Investigation and Experimentation	6	10.0%
1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:		
a. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.	✓	
b. Identify and communicate sources of unavoidable experimental error.	✓	
c. Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.	✓	
d. Formulate explanations by using logic and evidence.	✓	
e. Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.	✓	
f. Distinguish between hypothesis and theory as scientific terms.	✓	
g. Recognize the usefulness and limitations of models and theories as scientific representations of reality.	✓	
h. Read and interpret topographic and geologic maps.	✓	
i. Analyze the locations, sequences, or time intervals that are characteristic of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).	✓	
j. Recognize the issues of statistical variability and the need for controlled tests.	✓	
k. Recognize the cumulative nature of scientific evidence.	✓	
l. Analyze situations and solve problems that require combining and applying concepts from more than one area of science.	✓	
m. Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.	✓	
n. Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets).	✓	
TOTAL	60	100%

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